Bay Grasses in Classes 2006

Wild Celery Protocol

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Contact Information

If you have any Bay Grass related questions, please contact:

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Mailing Addresses:

MD Department of Natural Resources
Tidewater Ecosystem Assessment, D-2
580 Taylor Avenue
Annapolis, MD 21401
Tel: (410) 260-8630
Fax: (410) 260-8859

Chesapeake Bay Foundation
6 Herndon Ave.
Annapolis, MD 21403
Tel: (410) 268-8816
Fax: (410) 268-6687

Bay Grass Information on the Internet

Use the Internet to visit bay grass related web sites and find out what's going on with bay grass in your area and elsewhere!

- **http://www.dnr.maryland.gov/bay/sav/bgic/** - Maryland Department of Natural Resources bay grass information page. Includes: identification key for Chesapeake Bay species, information on bay grasses, teacher questions, data from previous years of Bay Grasses in Classes, etc.

- **www.vims.edu/bio/sav -** Annual survey of bay grass distribution in the Chesapeake Bay. View maps to see current and historical bay grass distribution.

- **www.chesapeakebay.net/baybio.htm** - Chesapeake Bay Programs Animal and Plant page.

- **www.npwrc.usgs.gov/resource/literatr/wildcel/wildcel.htm** - Detailed information about the biology of wild celery.

- **www.gmu.edu/bios/Bay/cbpo/intro.htm** - George Mason University's BIOS Project, Introduction to an Ecosystem page.

- **www.cbf.org** - Chesapeake Bay Foundation(CBF).

- **www.wa.gov/ecology/wq/plants/native/water_celery.html** - Washington State Government, Department of Ecology, Water Quality Program, Native Aquatic Plants Information.

Reminder For Teachers

IMPORTANT NOTE

Included at the end of this packet are a Photo Consent and Release form and a Volunteer Form. Students must have both signed by a parent and returned to teacher before the planting event. Students who do not have a parent's signature WILL NOT BE ALLOWED TO PARTICIPATE!

Teacher Instruction Checklist

Please add these items to your calendar, where appropriate.

Before tank set-up and seed planting:

- ☐ Make 15 copies per growth chamber of the Bay Grasses in Classes Data Form found at the end of the protocol. Put the data sheets somewhere prominent, where they will be easy to fill out on a regular basis. (Page 20). If you use on-line data entry, there is no need to make copies.
- ☐ Find good location for growth chambers– they will be heavy once they are filled with water. Set aside 24 cups of sand for seed dispersal later. Sand should be as dry as possible. Set it aside to dry out for several days if necessary.
- ☐ Plant seeds by March 1st.

After tank set-up and seed planting:

- ☐ Fill out "Experiment Diagram and Growth Chamber Set-up" and "Initial School Data" forms and fax them to DNR at (410) 260-8859 immediately after planting seeds. (Pages 19 and 21).
- ☐ Send grant application to Chesapeake Bay Trust for transportation costs.
- ☐ Check water level and height of lights above water every week. (Page 17).
- ☐ If seeds have not germinated 2 full weeks after planting, call Mark Lewandowski at (410) 260-8634. Look Closely!
- ☐ Enter data on-line at the DNR website at http://mddnr.chesapeakebay.net/bgic/loginindex.cfm If you do not have access to the Internet, fax data to MD-DNR each week, 2 pages per week at (410) 260-8859 (page 20).
- ☐ Make sure to fill growth chambers with water before Spring Break.

At end of project:

- ☐ Prepare grasses for transport to planting event. Follow instructions in protocol (page 18).

Bay Grasses in Classes Overview

Overview:

Students assemble two bay grass growth chambers and grow wild celery *(Vallisneria americana*) from seeds in multiple containers. The experiment will be conducted between the two growth chambers. Students investigate the effects of various environmental factors on the health of the plants while learning about the importance of bay grasses to the Chesapeake Bay. Growth data can be entered on-line at http://mddnr.chesapeakebay.net/bgic/loginindex.cfm. If you do not have Internet access, data can be faxed weekly to Maryland DNR to be posted on the ***Bay Grasses in Classes*** website. Students will be able to compare their results with those of the other participating schools. Students will then assist scientists in planting their classroom-raised wild celery in areas of the Chesapeake Bay designated for bay grass restoration.

Maryland State Assessment Indicators:

- **Mathematics**: Computation; Estimation; Statistics; Number Relationships
- **Science**: Nature of Science; Habits of Mind; Processes of Science; Applications of Science
- **Reading**: To be Informed; To Perform a Task
- **Social Studies**: Geography
- **Writing:** To Inform; To Perform a Task

Estimated Time:

Total Project Duration: 75 days

- System setup-3 hours first week
- System measurements-5 minutes daily
- System maintenance, monitoring, data reporting-20 minutes weekly
- Planting event-1day

NOTE: Time estimates are for groups of about 6 students.

Project Timeline

January - February:

- $ Attend a Bay Grasses in Classes training workshop.
- $ Begin classroom activities from Experiments section.
- $ Use Chesapeake Choices and Challenges curriculum.
- $ Prepare for growing bay grass.
- $ Set up the bay grass growth chamber.
- $ **Plant seeds no later than March 1st.**

March - May:

- $ Grow bay grass.
- $ Keep track of bay grass growth and water quality data and enter data on-line or fax to MD-DNR at 410-260-8859.
- $ Use wild celery in classroom activities and experiments.
- $ Use "How Do the Cells of Wild Celery Compare With Other Cells?" activity found in the experiment section.
- $ Compare your growth rates with those from other schools in the project on the website at **http://www.dnr.maryland.gov/bay/sav/bgic/**

May - June:

- $ Attend field trip and assist Maryland DNR and Chesapeake Bay Foundation (CBF) in planting your classroom-raised wild celery.
- $ Reflection: have students reflect on their project. In the past, students have created posters, books, photo albums, mobiles, etc. about their involvement in Bay Grasses in Classes. See activities in the Choices and Challenges curriculum and the experiments section of the binder.

Bay Grasses Information

Introduction

How does the Chesapeake Bay keep itself healthy? Just like people rely on their immune systems to fight off germs and viruses, the Bay relies on many factors to fight the effects of sediment and nutrients that wash into it from the land. One of these factors is the bay grass or Submerged Aquatic Vegetation (SAV) that grows in the Bay and in many Bay tributaries.

Bay grass helps to keep the Bay in good shape in a number of ways. By slowing water movement, bay grasses help remove suspended particles from the water. Bay grass beds also stabilize the sediments that are already on the bottom of the Bay, absorb nutrients from the water, produce oxygen, and serve as food and habitat for multitudes of aquatic creatures.

Unfortunately, the Bay's grasses have been overwhelmed by the same pollutants that they remove from the Bay: sediments and nutrients. When too much suspended sediment from runoff clouds the water, or when excess nutrients cause algae blooms, bay grasses are sometimes not able to get enough sunlight to grow. When beds of bay grass die, the Bay loses important habitats.

This project will allow your class to grow wild celery, a type of bay grass, in the classroom. After your plants are grown, you will work with the Maryland DNR and the CBF to plant the bay grass in a tributary of the Chesapeake Bay!

Preparation - Educate yourself and your students about bay grass

Before you conduct this project, it is important that you understand the connection between bay grasses and good water quality. Use the activities found in this packet such as "**How Scientists Identify a Planting Area**," "***Vallisneria americana* Fact Sheet Activity**," "**How Do the Cells of Wild Celery Compare With Other Cells?**," and the **Pre-Lab Activity**. These activities were designed specifically for the Bay Grasses in Classes project. Also, use the activities: "**Please Don't Feed the Bay**," "**When Rain Hits the Land**", "**A Little Puddle at the Bottom of a Big Hill**," "**What Is Your Watershed Address?,"** and **"Submerged Aquatic Education**" from *Chesapeake Choices and Challenges* to determine what sorts of land uses affect bay grass and how the bay grasses have been doing in the river nearest to you. **All of these activities are on the DNR website at http://www.dnr.maryland.gov/bay/sav/bgic/**

Materials

Total List for 2 growth chambers
(Note: All materials will be provided by Maryland DNR/CBF unless otherwise noted.)

2 - growth chambers
2 - sponge filters
2 - power heads
4 - incandescent light bulbs (75 watt)
4 - swing arm desk lamp
2 - power strips with surge protectors
2 - ground fault interrupters (GFI)
2 - thermometers
2 - submersible aquarium heaters (Second Nature Acura 1000- 150 watt)
1 - pH test kit
1 - nitrate test kit
8 - planting trays
1 - foam sheet
1 - wild celery seed package
1 - quart size freezer Ziploc bag
2 - bags of topsoil B (25 pounds, lower organic content than potting soil)
2 - *bags of sand (50 pounds)
1 - *ruler or yardstick for height measurement
1 - *cup measure
1 - *5 gallon bucket (for mixing sediment and adding water)
1 - *about 100 feet of string (depending on the height of your ceilings) - optional

Not provided

NOTE: *It is extremely important to keep the wild celery seeds refrigerated (not frozen) until planting*

Growth Chamber Assembly

Part 1- System Set-up

(Note: Read all instructions for Part 1 before beginning)

Step 1– Separating seeds Done prior to tank set-up (30 minutes)

At least one day before you want to plant the wild celery seeds, break each pod into several pieces. Squeeze out the seeds and gelatinous substance that encases them into a jar of cold water. The gelatin will break down in about 24 hours. Place this jar in the refrigerator until you are ready to plant the seeds.

Step 2 - Assembling growth chamber

It will take one hour to completely setup one chamber. You can break the class into two groups and do both chambers at the same time. **Depending on your experiment, you will need to adjust your tank assembly. Please read the specific directions in the Experiment Section of the manual.**

Materials

2 - growth chambers
4 - desk lamps
4 - incandescent light bulbs
2 - power heads
2 - sponge filters
2 - power strips
2 - ground fault interrupters (GFCI)
2 - submersible aquarium heaters (Second Nature Acura 1000-150 watt)

Procedure

1. Once you have all the parts for your bay grass growth chamber, you will need to assemble them in your classroom. If split into two groups, a class of 15 students or more should be able to prepare the growth chamber in one hour. The growth chambers will be very heavy (approximately 100 lbs.) and difficult to move once filled, so choose your location carefully. If possible, do not place by a window.

2. Place chambers on table. Make sure the table has strong legs, and is near an empty wall outlet. Label the outside of each chamber clearly with an “A” or a “B”.

3. Assemble the lights and clamp them to the table so they can sit about 21 cm (10 inches) above the top of the chamber. Plug the lights into the power strip. Make sure a drip loop* is set up to prevent water from accidentally dripping into the power strip socket. See Figure 1.

Teachers Note: It is up to the individual teacher to determine safety precautions to be taken with the lights. If accidentally submerged into the water, the light bulbs will burst and an electric shock of standard household current (120 volts) could result. Anything plugged into an outlet or power strip should have a drip loop to prevent water from accidentally dripping into the socket. See diagram on next page.

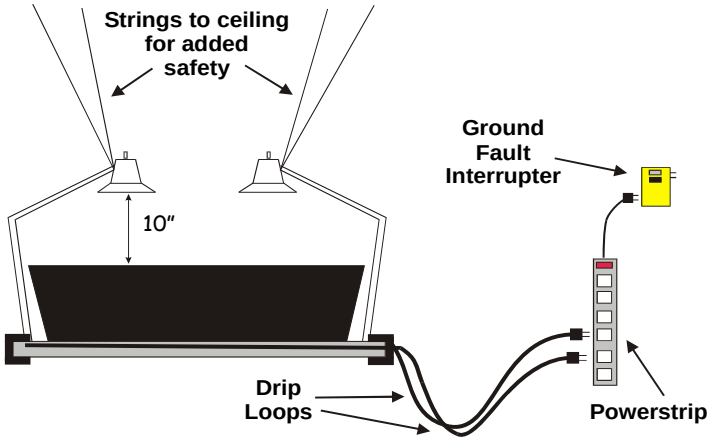


Figure 1- Tank Set up

4. Prepare the power head by attaching the cylindrical plug of the power head to the water intake of the power head. Then attach the sponge filter by stretching it over the adapter (See Figure 2). The sponge filter will prevent particles from clogging up the power head. In addition, it provides a medium for beneficial bacteria to grow. The bacteria will convert other forms of nitrogen to nitrate, which will help the plants to grow.

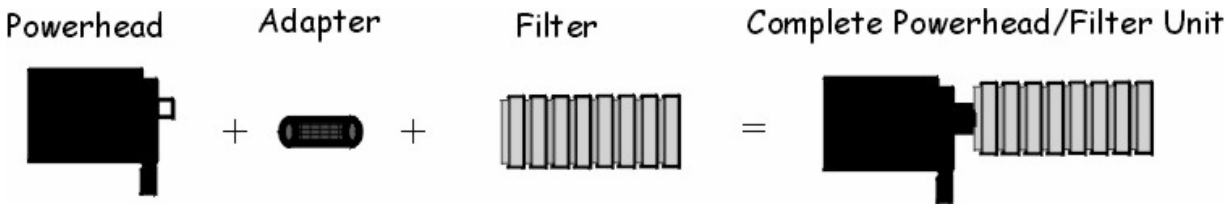


Figure 2 - Power head Assembly

(Expect to have many extra parts in the box that will not be needed.)

5. Place the power head in the short end of the tank, attaching the suction cups to the side and facing the flow down the center of the tank (See Figure 3)

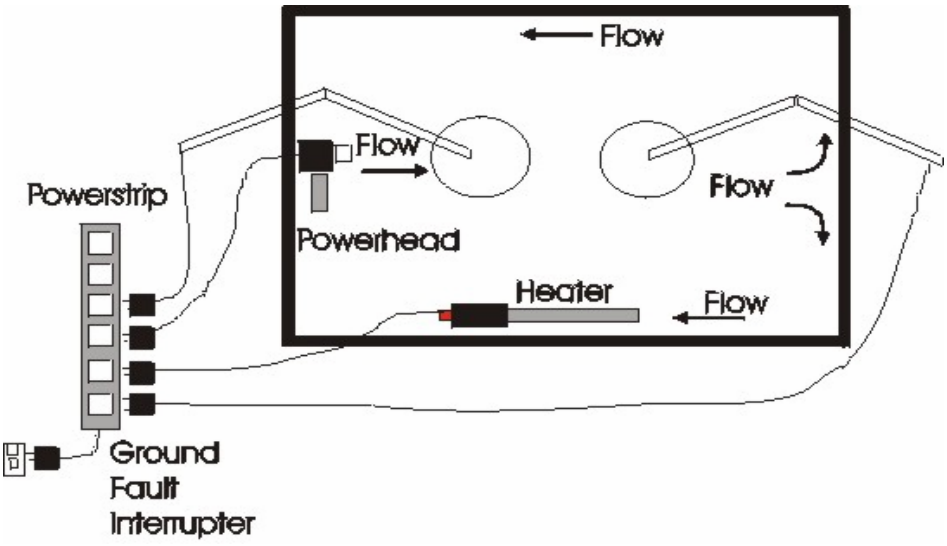


Figure 3-Placement of power head

Step 2 -Assembling growth chamber (continued)

Materials
2 - bay grass growth chambers (from Step 2)
2 - thermometers
2 - water quality test kits (Nitrate, pH)
Initial Water Quality Data Form

Procedure

1. Fill each growth chamber with tap water to 10 cm (4 inches) deep.

2. Set the *unplugged* heater to 75 degrees F and lay it in the bottom of the growth chambers. Plug it in to the power strip.

3. Set up drip loops on all cords so that water cannot run into the outlet. (See Figure 4)

4. Plug the power strip into the GFCI and then into the outlet as in the diagram below.

5. Plug in the filter/filter (and leave it on). It should immediately begin circulating water in your growth chambers. Remember to set-up the drip loops!

6. Put the thermometer into the water. It can be attached to the side of each growth

chamber with the suction cup, or it can float free.

7. Using the instructions in the test kit boxes, test the water quality of your school's tap water using the nitrate and pH test kits. Record this data on the ***Initial Water Quality Data form.***

8. The assembled growth chambers will look like this:

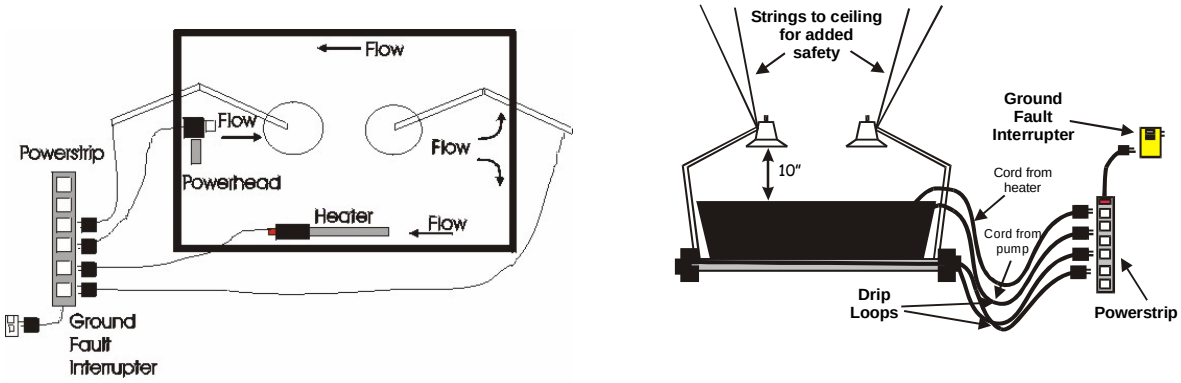


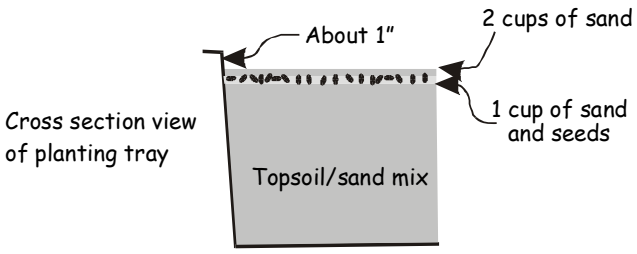
Figure 4- Assembled Growth Chamber

Part 2- Preparing planting trays

(Note: Read all instructions for Part 2 before beginning.)
It will take one hour to prepare all of the planting trays

Materials

1- container of bay grass seeds
2- bags of sand
2- bag of topsoil
1- foam sheet
8- planting trays
1- quart size freezer Ziploc bag
1 - 5-gallon bucket (Not provided)
1 – Ruler or yardstick (Not provided)
1 - Cup measure (Not provided)



*** Teachers Note: It is extremely important to keep the wild celery seeds refrigerated (not frozen) until planting.*

Procedure

1. Set aside 24 cups of sand from the first bag for use later with distributing seeds.

2. Thoroughly mix one bag of topsoil and the second full bag of sand in a container to a homogeneous mixture in a bucket or black tub.

3. Use a permanent marker to label the lip of each of the six planting trays so that you can tell them apart. (Example: A1, A2, A3, A4, B1, B2, B3, B4)

4. Fill the 8 planting trays with the sediment mixture until all 8 are equally full. Pack the sediment in each tray firmly with your fingertips.

5. Divide the seeds into 8 equal parts by using filter paper or pour out the water using a spoon. The easiest way is to divide the pile in half, then each of those piles in half, etc.

6. In a quart size freezer Ziploc bag, add **1** of these 8 portions of seeds to 1 cup of the sand that was set aside. The sand should be as dry as possible before you add the seeds.

7. Shake this mixture in the quart size freezer Ziploc bag for 2 minutes.

8. Sprinkle this sand/seed mixture evenly over the sediment mixture that is in the planting tray.

9. Sprinkle an additional 2 cups of sand from the sand set aside over the sand and seed mixture. This should be a very thin layer (about 1/8 of an inch). If this layer is too thick, your seeds will not germinate.

10. Lay the foam sheet on top of the sediment surface. Remember: once the foam is in the

water, it will float, so hold it in place tightly.

11. Two people should **gently** lower the trays into the first growth chamber. Tip one end of the tray when lowering, **slowly**. Hold the foam in place on top of the sediment surface until all bubbling has stopped. This may take quite a while (up to one minute). This will minimize disturbance of the sediment and movement of seeds.

12. Remove the foam sheet carefully by lifting one end slowly. Repeat procedures 6 through 12 until each growth chamber has 4 trays in it.

13. Fill growth chambers with more water until water depth is17 cm (7 inches). Check this level weekly and add water when necessary. Be careful not to disturb the sediment. Turn on the lights if not on already.

14. You are now ready to monitor your bay grass. See the next page for details. Remember: Week 1 = the first week that germination is noticed.

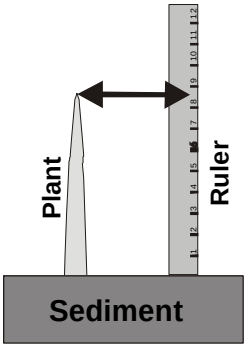
Teacher's Notes: Wild celery seeds will typically take about 7 -10 days to germinate.

Part 3 - Monitoring your Bay Grass

Materials
2 - thermometers
1 - ruler
1 - pH test kit
1 - Nitrate test kit
1 - Bay Grasses in Classes Data Log

Procedure
You will need to consistently monitor the growth of the bay grasses and the water quality in the growth chamber. A pair of students can easily do the daily monitoring during the first five minutes of each class period, and the weekly monitoring should take no longer than 20 minutes. ***Record your monitoring information on the 2003 Bay Grasses in Classes Data Log.***

1. Daily Monitoring (record the following information)
$ Water temperature - in Fahrenheit Degrees
$ Water level in the growth chamber Fill to 16 ½ cm daily (or 6½ inches)
$ Height of the light above the water surface. Should be 25 ½ cm (or 10 inches)
$ Any additional observations or comments



2. Weekly Monitoring
Week 1 = the first week that germination is noticed
$ Water chemistry (pH, Nitrate) See instructions in box
$ Plant height above sediment (measured in cm, NOT inches) (Tallest plant in each tray and the average within each growth chamber)
$ Any additional observations or comments

Submitting your data: Each week, go to the DNR on-line data entry page of the website at http://mddnr.chesapeakebay.net/bgic/loginindex.cfm to enter data for each growth chamber. If you do not have internet access, fax the completed ***Bay Grasses in Classes Data Log*** *(page 19)* to the Maryland DNR at 410-260-8859. Remember to send one sheet for each chamber each week. Your bay grass data will be compiled with data from all other participating schools and placed on the ***Bay Grasses in Classes*** website. You will be able to compare the growth of your plants with all the other participating schools by going to **http://www.dnr.maryland.gov/bay/sav/bgic/**.

Teachers Note: It is OK to ignore the plants for up to a week at a time PROVIDED THE WATER LEVEL IS ADEQUATE. If the water level drops below the powerhead intake, it will break, and an electrical shock could result. A water level drop of about 5 cm per week is normal, but this could vary significantly from school to school. Be sure that growth chambers are filled before leaving for spring break or long weekends

Part 4 – Preparing for Planting Your Bay Grass

Maryland DNR and the CBF will identify a nearby site for bay grasses restoration. When your plants reach adult size, (about 60 days) you will be able to assist scientists in planting your bay grasses at this restoration location. Your plants, along with those of the other participating schools, will increase the size of the new bay grass bed and will increase both its ecological value and its chance of survival.

To prepare your bay grass for transport to the planting site:

1. On the bay grass planting day, remove most of the water from the bay grass growth chamber by siphoning or dipping, until the water level just barely covers the top of the planting trays. This will reduce the weight, making the chambers easier to transport.
2. In order to reduce the drying of plants during transport, cover the growth chamber with several sheets of wet newspaper. These should be placed directly on the surface of the plants.

3. When you arrive at the planting location, be sure to put your grasses in an area out of direct sunlight and add water to the chambers if possible.
4. Make sure that you label the 2 growth chambers with your school's name and teacher's name, since there will be many other schools planting the same day.

Teacher's Note: Funding assistance for transportation to Bay Grasses in Classes planting locations will be provided by the Chesapeake Bay Trust. Please complete the attached application form and return to the Chesapeake Bay Trust ASAP to provide time for processing. If you do not submit the form before the due date, costs will not be covered.

2006 Bay Grasses in Classes: Initial School Data

(black ink only please)

School:_____

Teacher:_____

Grade:_____ Class:_____

Phone Number:_____

Email:_____

Address:_____

_____

_____

Initial Water Quality (Tap water):

pH:_____

Nitrate:_____

NOTE: Please fax this page to Maryland DNR c/o Mark Lewandowski at 410-260-8859 after tank set-up.

2006 Wild Celery Data Log

School:_____ Teacher:_____

Grade/Class:_____ Week# 1 2 3 4 5 6 7 8 9 10 11 12 13 14
(week 1 = when germination is first noticed)

Experiment Type: (Circle one) Light Time, Flow Rate, Sediment Type, Temperature, Other

Chamber Type:_____(for example, # of hours of light, flow, no flow, salinity tank)

Daily Monitoring

Date (month/day)	**Water Temp** (˚F)	**Water Depth** (fill to 16.5 cm)	**Light Height** (should be 25.5 cm)	**Comments** (Date plants first visible, heavy algal growth)
Monday _____				
Tuesday _____				
Wednesday _____				
Thursday _____				
Friday _____				

Weekly Monitoring

Date	**Average Temperature**	**pH**	**Nitrate (mg/l)**

Plant Height (centimeters)					
Growth Chamber A or B *(indicate chamber type)*					
Date	Tray 1	Tray 2	Tray 3	Tray 4	**Average**
_____					

If you are doing a within tank experiment, please do not average the plant height data.** ***NOTE: Please fax this page to Maryland DNR c/o Mark Lewandowski 410-260-8859 at end of each week.

2006 Bay Grasses in Classes:
Experiment Diagram and Growth Chamber Set-up

School: _____

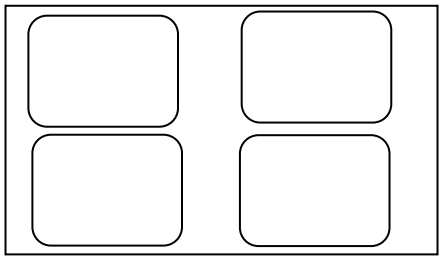
Teacher:_____Email:_____
(Please use black ink only. Fax to Mark Lewandowski at 410-260-8859. Thanks!)

Between Tank Experiment (Assigned):
(Please circle one.)

flow rate light time sediment type

temperature other

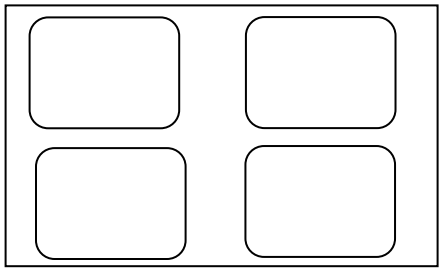
Growth Chamber A:



Please label all trays and indicate if it contains different sediment mixtures.

(Please circle all that apply.)
One powerhead (flow rate) no powerhead (flow rate)
24 hours (light time) ____ hours (light time)
75 degrees 84 degrees 92 degrees (temperature)
25%/50%/75% sand 25%/50%/ 75% soil (sediment type)

Growth Chamber B:



Please label all trays and indicate if it contains different sediment mixtures.

Please circle all that apply.)
One powerhead (flow rate) no powerhead (flow rate)
24 hours (light time) ____ hours (light time)
75 degrees 84 degrees 92 degrees (temperature)
25%/50%/75% sand 25%/50%/ 75% soil (sediment type)

Consent/ Release Form

As parent or legal guardian of _____, I certify that said child has my permission to attend and participate in the "Bay Grasses in Classes" Program sponsored by the Maryland Department Of Natural Resources. In signing this form, I acknowledge that my child will be participating in the following activities as part of this program: canoeing, seining, nature hikes, and planting grasses in Chesapeake Bay Tributaries. I also hereby grant the Maryland Department of Natural Resources the unconditional right to use the name, voice, and photographic likeness of _____in connection with any of their audio video production, articles, or press releases, but not as an endorsement.

I, _____, hereby give my consent for Emergency Medical Care to be provided for my child, _____, while he/she is participating in the " Bay Grasses in Classes" program.

Physician: _____
Phone Number:(_____)_____
Allergies: _____
In case of such an emergency during program hours, I can be reached at:
_____

_____
Signature of parent or legal guardian Date

RELEASE STATEMENT:

I acknowledge that there are natural hazards with activities in an outdoor setting. I hereby affirm that my child is in good health and physically capable to perform the required activities of the program. In consideration of the Maryland Department of Natural Resources Bay Grasses in Classes Program accepting my child and to the extent permitted and approved by State Law, I hereby release and forever discharge the State of Maryland, its units, agents, and employees from all claims of liability for any damages or injuries which may be sustained while my child is at camp to the extent permitted by state law.

_____ _____
Parent/Guardian Signature Date

Maryland Department of Natural Resources
Tidewater Ecosystem Assessment
Tawes State Office Building
580 Taylor Avenue D-2
Annapolis, MD 21401

Maryland Department of Natural Resources
Resource Assessment Service

Volunteer Information & Registration

This registration form between the MD Department of Natural Resources and each volunteer is subject to the following terms and conditions:

1. **Registration.** ALL volunteers must register on forms provided prior to doing any work. Registration qualifies the volunteers for State liability and medical protection.

2. **Duties.** No volunteer should undertake any work or use any equipment for which he/she is not trained and qualified. Volunteers are **not** permitted to drive a State Vehicle. Volunteers must use the same safety equipment required of the Department of Natural Resources personnel conducting similar activities. Volunteers who operate their own power equipment do so at their own risk.

3. **Liability.** Volunteers, like other State employees, are immune from tort liability if they are acting within the scope of their assigned public duties and without malice or gross negligence even if the damages exceed the limits of the State=s waiver of immunity. Volunteers sued for alleged negligence are eligible for State legal assistance provided the limitations are not violated. The Department of Natural Resources relinquishes any claim for loss or damage to State property which results from supervised activities in State facilities, provided those activities are conducted without malice or gross negligence.

4. **Medical Coverage.** The State Treasurers Office provides volunteers with accident/medical insurance in the amount of $2,500 for personal injuries and accidental death/dismemberment insurance in the amount of $10,000. Proof of claim forms must be submitted to the Department of Natural Resources within thirty (30) days of the date of the accident.

5. **Coordination.** The volunteer program will be coordinated by Mark Lewandowski. Specific questions or concerns should be address to her/him at 410-260-8634. This form covers the period of ____4/29/06_____ to _____6/20/06_____.

Volunteer Name:_____
Address:_____
_____
Telephone:_____

I acknowledge that I have read and understood the above information and understand that by signing this statement I am considered a DNR volunteer.

Signature_____ Date: _____